Appendix A

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Updated Information
Railroad Rights-of-Way (RR ROW)
Alternative Vegetation Management Strategies
February 2016

ALASKA

•Alaska did not apply pesticides on their rail from 1983-2010.

Alaska Railroad

•Examples of RR public relations/information sheets:
https://www.alaskarailroad.com/corporate/safety.

•Also found on Alaska Railroad's website:

overview of vegetation management challenges
Integrated Vegetation Management Plans (IVMPs) from 2013, 2014 & 2015
a FAQ page related to vegetation management
an alternative methods for vegetation control evaluation and implementation summary
herbicide fact sheets
herbicide additives fact sheets
links to further resources of interest
an herbicide research project fact sheet
research from 1991-98 on alternatives
a critique of five potential solutions and seven other control strategies, including hand, steam, hot water, flame burning, infrared, costs; weed barrier, brushing, vacuum clearing, hot air, freezing, electo-thermal, ultraviolet light
a list of current non-chemical controls they still utilize (mechanical brush-cutter, ballast regulator, and manual labor) as well as the shortcomings of these methods

•a copy of the FRA letter to the ARRC regarding their vegetation concerns

This section is of the letter is of particular relevance to our current conversation about alternatives:

We also understand that ARRC's vegetation management difficulties have been complicated by its inability to spray herbicides. . . . We also understand that ARRC applied for a DEC permit to spray herbicides in June of 2006. The ARRC application sought permission to spray herbicides on approximately 500 miles of track and 100 miles of rail yard. DEC denied the permit application in February 2007. As a result, ARRC has continued to attempt to control vegetation with non-chemical methods such as mechanical brush cutting, manual labor, and steam and burning. However, these techniques have failed to bring ARRC into compliance with FRA vegetation requirements under 49 CFR 213.37.

•In 2014, they used two mixes: Mix 1: Oust Extra (3oz), Aquamaster (40 oz), and Agri-Dex (32oz) (surfactant). Mix 2: Oust Extra (3oz), Aquamaster (56 oz), and Agri-Dex (32oz) (surfactant).

MAINE

Please see PDF (found through Maine's website: Maine.gov).

• Maine has an online explanation for their choice to use herbicides. They address international attempts to test alternatives, "the use of steam, infrared radiation, mechanical disturbance, hand labor, mechanical brush removal, controlled burn, open flame burning, hot water, weed barrier,

vacuum clearing, freezing, electro-thermal, ultraviolet light, and establishment of monoculture crops such as low growing grass or clover." They also explain the various zones of the track and control needs within these in great detail.

They no longer allow products with surfactants to be used, as surfactants increase mobility of the product. They use pinolene, which keeps the herbicide in place for 3-4 weeks and rain-fast within 30 minutes.

MASSACHUSETTS

http://www.mass.gov/eea/docs/agr/pesticides/rightofway/vmp/csx-ma-vmp-2015-2019.pdf

•*Alternative control methods have been attempted in the past. The Massachusetts Railroad Association, of which CSX Transportation is a member, has tested several alternatives without success:*

No mechanical equipment has been developed that will operate in close proximity to the track components in the roadbed area. In 1996, Consolidated Rail Corporation, predecessor to CSX Transportation in Massachusetts, built and tested a mowing machine specifically for target vegetation growing in the roadbed and ballast. This machine was completely ineffective at removing vegetation below the top-of rail height, and fouled the ballast with plant clippings, creating both drainage problems and a fire hazard.

A steam application which required 7,000 gallons of potable water and several hundred gallons of diesel fuel per railroad mile for heating the water resulted in partial weed control lasting about one week.

In another test, an application of a fish by-product resulted in approximately ten percent control of target vegetation.

Manual weed control using conventional mowers, weed trimmers, or brush trimmers has proven similarly ineffective at removing vegetation from close proximity to rails, switches, and other steel structures.

Manual techniques for weed control will be used in areas where herbicide use is prohibited, where necessary, but they are not an effective alternative for vegetation management on most of the railroad rights-of-way.

CANADIAN PACIFIC RAIL (CPR)

•In a 2009 public comment to the Alaska Department of Conservation, the Alaska Community Action on Toxics (ACAT), a group opposing herbicide use along RR ROW), stated, "The Canadian Pacific Railway implemented hot water technology as a 'primary management tool' on a portion of its track in the Pacific Northwest."

http://www.akaction.org/wp-content/uploads/2013/03/Comments_to_ADEC_09-15-2009.pdf

•CPR's 2010 IVMP explains why alternatives to chemicals, such as steam and boiling water, have been abandoned. It also mentions that opportunities for chemical reduction may be found in application technologies. Please see excerpts below and accompanying document.

http://www.cpr.ca/en/communitysite/Documents/CP%20integrated%20vegetation%20mgmt%20plan.pdf

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CPR has been actively involved in the large scale testing and evaluation of non-chemical vegetation management techniques like steam and boiling water for many years. However, these methods have shown to be ineffective and have been abandoned. In more recent years it has been found that the greatest opportunities for herbicide use reduction lie with advanced application technologies that can significantly enhance the precision with which herbicides are used.

•Weedseeker®: spot spray system which uses infrared optics to detect chlorophyll in plants / weeds has been shown to be very effective in reducing chemical usage by applying herbicide only where green foliage is present on the ballast section and is currently the default control method for weed control in the ballast section.

•Chlorovision®: is a new generation automated weed identification and herbicide application system currently being developed by one of CPR's service providers. This system accurately identifies vegetation within a 10 meter wide treatment zone with pinpoint accuracy and automatically controls the rail based application equipment to precisely treat only the targeted vegetation. This system includes an integrated GPS that creates a report on a daily basis, including images and GPS coordinates. Full scale field testing of this technology is scheduled to commence in 2010.

•WetBlade® and OnePass®: CPR is also investigating the potential use of technologies that combine traditional mechanized cutting of unwanted vegetation with sequential wick application herbicide treatment.

CPR will continue to consider other new chemical and non-chemical vegetation control methods as they are developed.

Other Resources & Related Information

•*Progressive Railroading*:

Under Vegetation Management in the"Topics" section, there are overviews of various vegetation control companies' strategies to improve efficiency. Some include computer systems with Chlorovision. Some have designed equipment that can cut brush and spray at the same time, which improves results.

http://www.progressiverailroading.com/mow/article/Maintenance-of-way-Vegetation-managementweed-control--29873

http://www.progressiverailroading.com/mow/article/Vegetation-management-a-product-and-service-update-part-1--43744

• Ballast Reconstruction, Surfacing and Cleaning

http://www.cpr.ca/en/community-site/Documents/CP%20integrated%20vegetation%20mgmt%20plan.pdf

New ballast is free of organic matter and fine particles and does not require vegetation management for several years. Fine particles are deposited in the ballast over time as a result of the continual fracturing and powdering of the ballast rock by moving trains. This, coupled with organic matter being deposited by the wind (dust), from seed sources both within the right-of-way and from adjacent properties, from decomposing plant material that has died on the ballast, and by migration from underlying soils (mud pumping), makes the ballast a suitable area for vegetation to become established over time.

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Ballast resurfacing is a technique that, as a side benefit, temporarily disrupts the growth of unwanted vegetation in the ballast areas. Alone, ballast surfacing is not an effective technique for controlling vegetation. Surfacing involves tamping the ballast area to increase the density of the ballast material and is used to restore the geometry of the track vertically and horizontally.

Ballast cleaning is undertaken to improve drainage and to increase ballast strength. Depending on how the ballast cleaning is done, it may remove some of the vegetation and organic material in which the vegetation is growing. Ballast cleaning can be done in two ways. The first involves adding new ballast and then raising and tamping the area. Although this provides a small layer of clean ballast on the surface, it does not remove the organic materials below. As a result, the organic material is still present to retain water and provide a medium for further weed growth.

Complete ballast cleaning will return the ballast to the same condition as with ballast reconstruction. Due to the relatively high cost of this technique, it is not suitable as a primary management technique, but merely provides a secondary benefit from planned resurfacing programs instituted for operational reasons.

•Railroad ROWs have different considerations than other ROWs

(The following paragraph was excerpted from CSX Transportation Inc 2015 VMP)

http://www.mass.gov/eea/docs/agr/pesticides/rightofway/vmp/csx-ma-vmp-2015-2019.pdf

Railroad rights-of-way are similar to other rights-of-way in that they are linear properties that pass through privately- and publicly-owned land in varied environments. However, the railroad rights-of-way are different from some other rights-of-way in that they are owned by the railroad in fee (whereas electric and pipeline companies usually obtain easements which convey only specific use rights). Vegetation management on railroads also differs from some other rights-of- way in that much of the rights-of-way and railroad structures must be kept completely free of vegetation to ensure visibility and safety of train passage (compare, for example, electric utilities, which need only restrict the height of vegetation).

Vegetation itself is rarely directly the cause of a railroad accident or incident. Vegetation on railroad rights-of-way has a significant indirect effect on railroad safety. In 2014, the last complete year for which data are available from the Federal Railroad Administration (FRA), a total of 402 accidents nationwide were attributed to track defects. Railroad accidents result in property damage with very significant costs, lost productivity of our transportation system, injuries, and sometimes fatalities. The significance of careful inspection and maintenance of the railroad, including the prevention of interference with vegetation, cannot be overstated.

The primary method for minimizing accidents caused by track and roadbed defects is the federally-mandated periodic visual inspections of rails and associated structures by a qualified track inspector.

Inspections are normally done from a hi-rail vehicle, supplemented when necessary by walking inspections of switches and other complicated track work. It is essential that the roadbed be kept free of vegetation to provide the track inspector with unobstructed views of the track structure including rails, ties, and fasteners. Vegetation within the roadbed increases the probability that a track or roadbed defect will go undetected resulting in greater potential for an accident. Vegetation in the roadbed hinders other methods of track inspection as well. Railroads employ electronic rail testing to periodically test rails for internal defects. This testing is done by special rail cars that establish a magnetic field around the rail. Vegetation adjacent to the rails hinders this process and can result in invalid tests. Other special rail cars measure track geometry such as surface, line, and gauge. The gauge measurement is done optically and is adversely affected by vegetation between and above the rails.

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•Seeding the ROW

http://www.cpr.ca/en/community-site/Documents/CP%20integrated%20vegetation%20mgmt%20plan.pdf

Seeding disturbed areas with native grasses or low-growing vegetation can be an effective method of preventing the establishment of Noxious Weeds, invasive plants and woody vegetation. Re-vegetation strategies that are compatible with railway safety requirements as well as ecological values are considered as part of the environmental assessment process for all new construction projects on CPR.

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•Establishing Thresholds

http://www.cpr.ca/en/community-site/Documents/CP%20integrated%20vegetation%20mgmt%20plan.pdf

Table 2 Injury / Treatment Thresholds That May Trigger a Treatment Decision and Control Options

Zone	Location	Treatment Threshold	Control Action(s)
Ballast	main track	3% weed cover	chemical
	siding	5% weed cover	chemical
	back track, storage track	10% weed cover	chemical
	disused track	30% weed cover	mechanical & chemical
Right-of-Way	general	20% brush cover by area **OR** height over 1.2 m **OR** sight line formula*	mechanical & chemical
	signalized highway crossing	sight line formula *	mechanical & chemical
	non-signalized highway crossings / bridges	sight line formula *	mechanical & chemical
	access crossing	sight line formula *	mechanical & chemical
	pedestrian crossing	7 seconds clear sight at train speed*	mechanical & chemical
	curve	line of sight 100 m minimum	mechanical & chemical
	communication and electrical distribution lines	height over 1.5m	mechanical & chemical
	"danger" tree	tree height > 80% of distance to track	mechanical & chemical
Yard / Station Grounds	classification track	3% weed cover	chemical
	shop track	3% weed cover	chemical
	shop, building and work area	20% weed cover **OR** height (10% of weeds are > 0.5 m in height)	mechanical & chemical

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Communication and Signal Installations	buildings, bungalows, slide detection fences other wayside infrastructure	3% weed cover	mechanical & chemical
All	Noxious Weeds and invasive plants **	As per BC *Weed Control Act*	mechanical & chemical

* Sight line formula in accordance with Division 5, Sections 3.5.1 and 3.5.2 of the Railway Safety Code and Transport Canada RTD 12 Guidelines. Minimum Distances Required for Sight Lines to Crossings are shown in Table 2 of this IVMP.

**CPR actively works with Provincial, Regional District Inspectors and First Nation representatives to develop area wide Noxious Weed and invasive plant management strategies, treatment thresholds and management priorities.

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• Description and Rationale, Benefits and Limitations of Manual and Mechanical Control Methods

http://www.cpr.ca/en/community-site/Documents/CP%20integrated%20vegetation%20mgmt%20plan.pdf

Description & Rationale	Benefits and Limitations
Hand Pulling and Cutting are viable manual control methods for spot control of certain established weeds that can be easily uprooted, such as young tree seedlings, clumps of grass, and small patches of noxious weeds and invasive plants where the roots can be fully removed. Hand removal and cutting may be used around signs, switches, shops and buildings, or where chemical controls (herbicides) cannot be used.	These methods produce immediate results and can be conducted throughout the growing season. They are effective if the number of weeds to be pulled or cut is small and the site is a manageable size. These methods are costly, however, because they are slow and labour intensive. In addition, vegetative debris must be removed from the site and the re-growth of undesirable vegetation within the disturbed areas often occurs.
Weed Trimming can be used in areas such as along fence lines, around switches, signs and equipment, and in areas around buildings, shops, and material storage piles.	Weed trimming allows the problem vegetation to be cut to the ground level. When done early in the season, it helps remove seed heads. For small areas in close proximity to environmentally sensitive areas where herbicides cannot be used, it may be an effective non-chemical alternative. Weed trimming does not remove roots, however, and is only of limited effectiveness against weed species that reproduce from stem pieces.
Mowing and Brush Cutters are effective for the removal of brush and small trees from the right-of-way for the maintenance of sight line and other requirements. Mowers and brush cutters can work off track or can be modified to travel on railway tracks. They effectively cut most vegetation to a height of 10 to 20 cm, and extend from the shoulder of the ballast out into the inner portion of the right-of-way for 4 to 6 meters.	Mowing and brush cutting quickly removes vegetation, may reduce seed sources for ballast infestation, and leave treatment areas aesthetically pleasing. These methods, however, are slow, they remove all vegetation (including desirable plant species), and they encourage plant re-growth or suckering of species such as willow, alder, maple, cottonwood and Himalayan blackberry. In isolation these techniques also increase maintenance requirements over the longer term, can create a safety hazard for both workers and animals by leaving sharp, exposed cut stems, and can increase the fire hazard if the plant debris are not or cannot be removed. Mowing and cutting may sometimes be followed by the selective application of herbicides (e.g. products containing the herbicide active ingredients to cut areas including stems, emerging foliage and stumps to reduce the re-growth of unwanted deciduous vegetation).
Chain Saws are generally used in the outer portion of the right-of-way to remove or prune trees and tall shrubs that cannot be reached by mowers or brush cutters, for the removal of "danger trees" that pose a hazard	The use of chain saws provides immediate results and provides selective control of vegetation. They can also be used in areas where most herbicides cannot be used such as immediately adjacent to watercourses. The use of chain saws, however, is physically demanding,

of falling onto the track or neighbouring properties and for general tree removal to maintain sight lines on rights-of-way at curves and at road and pedestrian crossings.	and there is a risk of injury to the operator from wood debris and broken chains.

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•Vegetation Management on Specific Areas or for Specific Purposes

http://www.cpr.ca/en/community-site/Documents/CP%20integrated%20vegetation%20mgmt%20plan.pdf

Area Purpose of Use	Criteria for Using Herbicides for Vegetation Management
Ballast	Ballast section treatment includes all tracks within the IVMP area. As noted earlier, there are no effective non-chemical controls for ballast vegetation management. Historically, all major yards have been treated with herbicides annually, due to the treatment thresholds having been exceeded. Treatment of main tracks, sidings, and station tracks are carried out as and where required if the applicable treatment threshold has been exceeded. Factors such as track type, site details (e.g. the type of vegetation present and the presence of environmentally sensitive areas adjacent to proposed treatment sites), and past management results determine the priority, frequency, and type of vegetation management treatment selected. The track type is a major factor in determining the prioritization of ballast vegetation management each year. For example, primary yards and mainline tracks have the highest priority for vegetation management due to their high levels of traffic and associated safety concerns. Treatment with appropriate herbicide active ingredient(s) listed in Table 5 may be required for ballast vegetation management.
Rights-of-Way (General)	Areas within rights-of-way that are vegetated with a suitable and stable cover of low growing plant species that do not pose a fire or safety risk to the public, CPR or its personnel, receive only limited management. However, in instances where Noxious Weeds, invasive plants are present or where tall growing vegetation is impeding sight line requirements or compromising access to buildings, signals, communication and electrical infrastructure and appropriate herbicide active ingredient(s) listed in Table 5 may be used.
Maintain Sight Line Requirements	The maintenance of sight lines is most critical at vehicle and pedestrian crossings or at approaches to bridges. Deciduous vegetation has the capacity to re-sprout following mechanical control methods. Treatment with appropriate herbicide active ingredient(s) listed in Table 5 may be done by foliar application, application to cut stumps, to the basal bark areas of individual trees following mechanical cutting or mowing to stop re-sprouting, or applied in areas where mechanical methods are not feasible or practical.
Danger Trees	Treatment with appropriate herbicide active ingredient(s) listed in Table 5 may be done by application to cut stumps of individual danger trees following mechanical cutting to stop re-sprouting.
Noxious Weeds and Invasive Plants	The treatment of Noxious Weeds and invasive plants will be based on the advice of regional weed control committees and the legislative requirements specified in the BC *Weed Control Act*. Treatment with appropriate herbicide active ingredient(s) listed in Table 5 may be undertaken.