



Mississippi
Mills

Municipality of Mississippi Mills

Integrated Vegetation Management Plan

Roads and Public Works
August 2024

Preface

This Plan was created in a manner that it will compliment the Lanark County Integrated Vegetation Management Plan, 2022, through integration of the framework used by Lanark County.

Revision History

Revision Number	Date Issued	Description
0	August 15, 2024	Initial Issue

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1.0 Introduction

Integrated Vegetation Management (IVM) for roadsides relies on the use of various methods of control to reduce a weed or brush concern. These include cultural practices, use of competitive vegetation, biological weed control, planting of allelopathic species, mechanical, manual, and physical vegetation control; and chemical vegetation control (Monet 1992). Control is applied as required to zones of the roadside as well as using targeted methods and physically or chemically selective methods to reduce herbicide use and impacts (Ballard et al. 2004).

IVM principles focus on the use of two or more methods of control, as opposed to using only one method that may disrupt natural predators or control agents. Alternative vegetation management techniques extend to a multi-level approach using the techniques listed above but also involving administrative and public relations methods including staff training, community involvement programs and public education.

1.1. Characteristics of Mississippi Mills Road System

The Municipality of Mississippi Mills (Mississippi Mills) maintains roads within municipal limits except for roads maintained by Lanark County (i.e., County roads) and Highway 7 which is maintained by the province.

The total road distance maintained by Mississippi Mills is approximately 370 km. The majority of roads are two lane roads with gravel shoulders and there are 46 km of urban roads which include two and four lane roadways in Almonte. Roadside widths range from 5 m from edge of gravel to fence/bush line, to 15 m or wider. A ditch is typically present on rural roads within the roadside and usually marks the edge of the maintained area due to limits on vehicular access (such as mowers) and water location following rain events.

Municipality Characteristics

The soils and natural vegetation in Mississippi Mills largely impact road vegetation control operations. The soils in Mississippi Mills are partly rocky, with some areas of limited to no soil, exposed sections of granite and rocky soil that are not arable land but remain forested or covered by pockets of significant wetlands, both swamps and bogs. Parts of the municipality have highly agriculturally productive areas of sandy loams or areas of more alkaline soils resulting from the lakebed of the ancient Champlain Sea.

The forested areas in Mississippi Mills fall within the Great Lakes-St. Lawrence Forest region. The natural forests are mixed deciduous and conifer species listed below. The following native forest tree species are example of the trees that are brush concerns within clear zone and wildlife sight zone within roadsides.

- eastern white pine
- red pine
- eastern hemlock
- eastern white cedar
- white spruce
- balsam fir
- sugar maple

- red maple
- red oak
- basswood
- yellow birch
- white birch
- large tooth aspen

Brush species found on roadsides are commonly wind-dispersed species such as aspen, ash and maples; rhizomatous species such as aspen or white cedar which reproduces by stem layering.

Facilities

Mississippi Mills maintains two public works garages, two municipal office buildings, and four closed landfill sites, two of which currently operate as waste collection depots.

Parks & Trails

There are 18 parks and 3 trails in Mississippi Mills.

The parks are operated by the Municipality. The trails include those maintained by Municipality, Lanark County, and the Mississippi Madawaska Land Trust.

1.2. Vegetative Characteristics in Various Areas

The roadsides, trails, and facilities within Mississippi Mills have typical vegetation and specific control issues.

Agricultural Areas

- Shoulder zone either paved or gravel
- Grassed zone in most areas along road from 1 to 3 meters wide
- Typically grassed roadside to fence line
- Natural wet-area vegetation in zones
- Some agricultural uses are sensitive to unwanted vegetation growth (such as seed cultivation operations)

Issues include:

- Poisonous species for children, workers, and farm animals
 - Wild parsnip, giant hogweed, and poison ivy are some species
- Other noxious and tall weeds and brush
 - Species including thistles, knapweed, and dog-strangling vine
 - Milkweed not to be considered noxious
- Maintaining ditches for runoff water that are impacted by the noxious weed phragmites poses issues

Rural Property Areas

- Grassed zone in most areas along road from 1 to 3 meters wide

- Vegetation in zone beyond the ditch line
 - grassed roadside right up to fence line in some areas.
 - natural wet-area vegetation in zones
 - natural mixed vegetation right up to fence line

Issues include:

- Poisonous species for public especially children
 - Wild parsnip, giant hogweed, and poison ivy are some species
- Tall weeds obstructing sight lines
- Adjacent to agricultural and horticultural properties
 - Species including thistles, knapweed, and dog-strangling vine
 - Noxious and tall weeds and brush
- Maintaining ditches for runoff water that are impacted by the noxious weed phragmites poses issues

Forested Areas with or without Rural Properties

- Few areas with grassed zone along road from 1 to 3 m wide up to ditch line
- Rock areas and rock cuts limiting vegetation along roadside and access beyond ditch line
- Vegetation beyond ditch line
 - Natural woody vegetation right up to fence line
 - Natural vegetation right up to fence line
 - Natural wet-area vegetation in zones

Issues include

- Poisonous species
- Invasive weeds in forests and natural areas such as dog-strangling vine
- Site lines (tall) weeds and brush
- Animal site lines beyond safety clear zone

Facilities (non-public)

- Grassed zones non-crop areas, gravel loading areas; paved parking or equipment areas; and paved or unpaved laneway areas

Issues include

- Poisonous species
- Noxious weeds near agricultural areas
- Invasive weeds in forested and natural areas such as dog-strangling vine
- Maintaining access can be a year round process
- Snow storage can impact vegetation
- Maintenance of ditches for runoff water that are impacted by the noxious weed phragmites poses issues

Facilities (public)

- Grassed, gravel or paved parking/equipment areas and paved or unpaved laneway areas
- Natural mixed vegetation areas
- Natural wet-area vegetation in zones

Issues include

- Poisonous species
- Noxious weeds near agricultural areas
- Invasive weeds in forests and natural areas such as dog-strangling vine
- Maintaining safe access with considerations to poisonous species
- Snow storage can impact vegetation

1.3. Vegetation Goals

It is critical to carry out control operations with the vegetation goal of each site in mind.

Within Mississippi Mills, there are grassed zones along roadways which are mowed. Beyond this mowed strip or the ditch line, the vegetation is either cultivated turf, herbaceous species, or a naturally occurring species.

Mississippi Mills has the long-term vegetation management goal to establish roadsides with a diverse and extensive pollinator habitat. It is important to carry out plantings or to rely on naturalization to increase the diversity of flowering species along the roadsides in Mississippi Mills. Roadside plant diversity includes a natural species that flower throughout the growing season, dense vegetation cover to provide natural and biological weed control, and to establish natural and biological tree and brush control. In addition, vegetation creates natural Erosion and Sediment Control.

It is critical that vegetation control operations are implemented with the long-term vegetation management goal in mind. Spot/local control applications wherever possible may be used to limit injury to desired roadside species.

Suitable roadside and facility vegetation:

- Grassed areas (where possible and feasible):
 - Low maintenance at the roadside
 - Medium maintenance with regular mowing at facilities
- Competitive old field species and naturalized herbaceous species
 - Naturalized, planted, or seeded
 - MTO native seed mixes
- Legume communities, generally planted intentionally
 - Crown vetch,
 - Bird's-foot trefoil
- Shrub or short tree species of suitable mature height
 - Naturalized, planted, or seeded

2.0 Vegetation Control Methods

2.1. Mechanical Control

Mowing is done for weed control and for maintenance of the safety clear zone along the road generally to the ditch line using roadside mowers. In most areas the first swath is cut, but two swaths are cut where possible.

Brush cutting for control of woody species is done with mechanical equipment using a brush cutting head or attachment on equipment. Guard-rails along bridges are maintained to ensure clear sight lines.

Grading of the gravel shoulder is done to control weeds invading in this area as well as re-distribution of gravel on the road shoulder.

Mechanical removal of plants and debris limiting water flow in roadside ditches is carried out as needed using back-hoes and other equipment to dig and remove material.

2.2. Cultural Control

Cultural control of vegetation aims to adjust the area to suitable vegetation which complements the use and zone goals. Cultural control includes (re)establishing intended species.

Mowing of Roadside Turf

- Reduces height of turf and any weeds/brush improving site lines
 - Control of some annual weeds
 - Limits height of all weeds/bushes
 - Makes soil line visible for vehicles pulling off road
- Thickens up seeded turf
- Promotes tillering of the grass which thickens up the turf stand and drives growth
- May prevent noxious weeds from entering their seeding phase

Zones with Height Thresholds

When required, re-seeding following roadside construction is completed as per Section 3.8. Wherever possible, a minimum stand of vegetation is retained to promote the native vegetation to reestablish itself, sometimes not requiring re-seeding.

Natural vegetation grows beyond ditch line. In many places, this results in natural competitive species occurring in monocultures and mixed plant communities. Many of these species have been observed in roadsides in Mississippi Mills

Combination

Selective herbicide control of noxious and/or invasive weeds is carried out on mowed grass areas. Cutting of the weeds prior to treatment helps control of some annual weeds.

2.3. Chemical Control

Selective herbicide control of noxious and/or invasive weeds is done on large zones of roadsides in road sections up to 5 km long. The preferred chemical control method for Mississippi Mills is spot-spraying using a selective herbicide. In past years, boom spraying of roadsides was carried out with a truck mounted sprayed with manual controls and multiple spray heads, however boom spraying is not preferred.

3.0 Integrated Vegetation Management Program

3.1. Monitoring

The purpose of monitoring or carrying out weed audits in an IVMP program is to record the exact locations of the weeds or brush of concern for planning, information, and for contract management. This includes information for direction of public works operators and/or contractors and to perform quality control activities to assess the completion and effectiveness of control activities.

Monitoring focuses on primary weed concerns and for planning of future control activities. The needs for monitoring can change from season to season. Timing can be based on program needs, weed species, stage of growth, or on pending treatments.

Monitoring is carried out on a road by road basis, or on a section basis, for larger roads. Monitoring is undertaken by public works staff prior to contracting operations to determine road segments requiring treatment. Staff utilize manual reporting and Global Positioning System (GPS) recording from vehicles with entry into the Mississippi Mills Public Works Geographic Information System (GIS). Resident complaints are also logged and monitored by staff.

The inventory is used for data analysis, to prepare maps, and direct vegetation control plans for the season.

Examples of weed monitoring information include:

- Weed/brush species and locations
 - In safety clear zones include any species of weeds or brush above 0.6m in mature height
- On roadside areas and facilities
 - Poisonous plants, primarily wild parsnip and poison ivy are the top weeds of concern
 - All noxious weeds in agricultural areas
 - Problem invasive plants such as common reed grass (phragmites) or Japanese knotweed
 - New invasive/noxious weeds that are of concern including giant hogweed which is present in neighbouring municipalities
 - Tall herbaceous plants and brush (monitoring completed during public works road patrol activities)
 - That can obscure entry of deer, moose, and other animals onto road or attract these animals
 - That may spread into safety clear zone
 - Other items to potentially monitor:
 - sensitive areas such a wetlands and other non-spray zones

- desirable vegetation that should not be damaged by operations if possible

Information collected can be stored on the Public Works GIS system and updated as needed. Other methods of storing monitoring information may be used such as through road patrol software.

Regular Required Monitoring

Monitoring for early detection of invasive and noxious weed locations is critical to provide cost effective and operationally effective control. Timing of monitoring may be as below:

- Pre-season control plan to determine weed cover and for contract preparation purposes
- Weed species based timing
 - o Wild Parsnip
 - Early fall after seedling emergence
 - Spring from early to mid-May
 - o Poison ivy, sumac, and dog-strangling vine visible in September/October with fall red/yellow color
 - o Common reed grass (phragmites) in July ahead of fall treatment
 - o Giant hogweed in early summer with large leaves and flower heads
- Quality control monitoring and post-season/pre-season timing
 - o Treatment based timing
 - Where weed was previously recorded
 - Areas that were control methods were previously used
 - o Control monitoring intervals will be determined by the specific treatment impacts on weed/brush plants
 - Two months after treatment (if applicable for herbicide use)
 - Weed species based timing
 - For wild parsnip, poison ivy, and sumac, evaluate August to September
 - For wild parsnip (fall treated), dog-strangling vine, common reed grass (phragmites), and giant hogweed; evaluate in early summer after emergence.
 - o Revision to control plan
 - Evaluate weed control and new invasions
 - In-house field review of program
 - Preliminary contract information

Monitoring Procedures

Monitoring procedures will be different for each area but will follow the same general process.

For recurring control programs such as wild parsnip, all monitoring information should be recorded on the GIS system. This allows for reference and for comparison between monitoring periods.

Quality control and post-season/pre-season monitoring is done to evaluate control programs, review control effectiveness and for planning operations the following season. The purpose is to review:

- Initial symptoms of herbicide impacts on weeds within a week while retreatment is possible
- Effectiveness of each herbicide program on controlling the weed targets
- Follow-up control if needed in the treatment area
- Application concerns
 - o Weather
 - o Applicator
 - o Buffers
 - o No-spray zones
- Consider needs such as herbicide rotation
- Adjustments to program for next season
- Compare control from year to year and over period of years

Monitoring Process of Roadsides

Monitoring (auditing) is carried out on specific weed and brush species as well as the location of sensitive areas and non-spray zones:

- weed/brush species
- non-treat zones
 - o 1 m is a workable length that can be left untreated
- road section identifiers,
 - o location (using GPS), road asset ID
 - o tracking methods
 - Linear (start/stop), point, polygon
 - Details on size, trail width, laneway or other areas for control
 - Recording of hard features to use as location markers such as rail lines, buildings, fences
 - photographs

Linear method is preferred because it relates to on/off control of application equipment. Additional information may be recorded on the width of the weed patch as to whether additional far-reaching spraying or back pack equipment is required. As the preferred chemical treatment method is spot-spraying and control areas are typically at the roadside, the linear method is primarily used.

Monitoring Process on Trails and Facilities

Monitoring on trails and around facilities would be carried out for similar reasons, but control operations may be done on a manual basis, with hose and hand-gun or backpack sprayers, if chemical control is selected in these areas. Monitoring would be done of specific weed and brush species as well as the location of sensitive areas and non-spray zones.

- weed/brush species
- non-treat zones
 - o 1 m is a workable length that can be left untreated
- location identifiers
 - o latitude and longitude (using GPS)
 - o how to identify
 - start/stop, polygon, point

- additional information on species and characteristics

The linear method of data collection would be suitable for monitoring weeds on trails. Additional information may be required on the width or area of the weed patches (or use of polygon method) for contract management and planning.

Use of Monitoring Information

- Pre-season planning
 - Program planning
 - Budgeting
- Contract management
 - contract preparation based on areas needing treatment (roadside mowing or herbicide application)
 - use for information to contractor
 - digital or hard copies
 - quality control
 - in fall or early spring for treatments required following season
 - information for GPS controlled sprayers if applicable
- Herbicide application
- Records provided by contractors
 - exactly where treatments applied
 - amount of herbicide used
 - date and time of application
- Track progress from year to year and over period of years

3.2. Zone Management with Height Thresholds

Vegetation control and maintenance activities can be done in linear zones along the roadsides or in spots (from point A to point B as an example) to reduce the total area of control activities and to provide a natural transition to the neighbouring vegetative cover. This reduces the amount of herbicide used, will reduce the area for mechanical activities and reduce overall costs.

By using a spot-application approach for herbicides via zonal management, the amount of herbicide is drastically reduced which in turn increases the area of pollinator habitat.

If necessary, monitoring can reflect these zones or spot designations. These zonal designations can be recorded on Public Works GIS maps for reference and for contract management.

Zones

Zones include the physical Shoulder Zone, Ditch Zone, and Fence Line Zone as well as other zones that based on specific roadside or trail geometries/usage.

Linear Roadside Physical Zones

The below zones relate to the physical design and terrain of the roadside.

- Shoulder zone along the roadside
 - Width of 1m to 15m, or to ditch line
 - Slopes off from road surface for drainage purposes
- Ditch zone includes any wet areas on the ROW of any shape
 - Typically artificial
- Fence Line zone is composed of different types of terrain and vegetation
 - Remaining zone from ditch to fence line
 - May include intersections, horizontal curves, or other areas part of the fence line zone

Roadside Zone Safety Height Standards

These zones are not physical zones but are based on the safety requirements for traffic, public, and maintenance. The physical characteristics of these zones will vary.

Safety Clear Zone

- First 7m from the shoulder (from the roadside cross section)
- Vegetation goal is to be 1m or less (height) to provide clear line of sight for drivers and maintenance workers

Wildlife Sight Zone

- Width of 1 to 15m
- Other vegetation including mature herbaceous and woody plant with height limit of 1.2 to 1.5m
- May be directly to fence line on narrow ROWs.
- Areas beyond wildlife sight zone have no mature plant height limit.

Safety Barrier Requirements

- Clear of all vegetation
- Includes all bridges, culverts
- Standard 2m wide typically and 1m wide in sensitive areas such as wetlands.

Landowner Maintained No-Spray Zones

- Set-up through landowner agreements
- Areas being maintained and free from weeds of concerned (identified in the agreements) by landowners
- Maintained by landowner to meet Municipal Zone Safety Height Standards

Vegetation Zones Along Trails

- 1.2m height within 2m from trail bed
- Safety factor for trail traffic that is crossing/passing
- No height limit for vegetation beyond 2m of trail bed

Operational Vegetation Characteristics in Zones

Suitable vegetation characteristics will be used in designated zones

- Based on parameters such as physical qualities, prevention and habitat qualities, vegetation community heights, site location and usage.
 - Mature height
 - Competitive ability
- Established stands of competitive and pollinator habitat species are the ideal vegetation to protect and develop where suitable within the roadside ROW
 - Both herbaceous and woody species.

3.3. Vegetation Control Operations

Personal Protective Equipment

For any work in poisonous weeds use of personal protective equipment (PPE) to prevent skin exposure is important for staff, contractors, volunteers and any public working on their properties.

The Ontario Invasive Plant Council's (OIPC) "Wild Parsnip Best Management Practices in Ontario" contains a detailed guide of safety gear, proper use and removal procedure and clean-up in case of accidental exposure.

[http://www.ontarioinvasiveplants.ca/wpcontent/uploads/2016/07/OIPC BMP WildParsnip Feb182014 FINAL2.pdf](http://www.ontarioinvasiveplants.ca/wpcontent/uploads/2016/07/OIPC_BMP_WildParsnip_Feb182014_FINAL2.pdf)

Pattern of Operations and Equipment Cleaning with Invasive Weeds

Organization of operations along with equipment cleaning is essential for wild parsnip and common reed grass (Phragmites) control and will assist in poison-ivy control. Both these minimize equipment movement of seed or other plants parts to new areas.

Mechanical operations such as mowing and ditching must be done during the appropriate times from least infested sites to more heavily infested sites where any invasive weed species are located.

- This will minimize equipment and people movement of seed and rhizomes of invasive and poisonous plants such as wild parsnip, common reed grass (phragmites), and poison ivy.
- Use latest map of weeds audits to determine operations priority on an annual basis.

Equipment cleaning should be required for all mechanical operations coming in contact with weedy vegetation, including mowing and ditching. Equipment cleaning should be compulsory for all Municipal staff and a contract requirement for all contract staff.

- At minimum provide Ontario Invasive Plant Council's (OIPC) "Clean Equipment Protocol for Industry" as part of all contracts and work protocols

- Highly recommend to hold annual pre-season, compulsory, training sessions for any operators doing work mowing or ditching work or hand application for the Municipality.

Herbicide Choice and Rotation

For optimum results, it is important to match herbicide used to the weed/brush species being controlled. Post treatment monitoring will indicate whether control was effective. Rotation of herbicides used is important to preventing resistance from building up.

- Products with combinations of two herbicides will help in delaying resistance.
- Rotate to herbicides with different families of chemicals or change to a different method of control every few years to control any herbicide resistant plants that are present

Control in Areas with Public Access

Herbicide use should be limited in these areas so control must be focused on mechanical and cultural methods including use of competitive vegetation. In general, herbicide use should be discouraged in urban areas unless it is considered to be the best option.

3.4. Options for Weed Control

Site Line Weeds and Noxious Weeds

Control methods for Annual and biennial weed, perennial weeds and brush species (see below)

Mechanical/Manual Control:

- Regular mowing or cutting can reduce the height of vegetation in the safety clear zone. It will not control many biennial and perennial species so these will regrow, but it will maintain a safe height for road operations if done regularly.

Chemical Control

- Spot application of post-emergence selective herbicide products to control emerged weeds and retain the grasses. Spot applications should be used to target and reduce herbicide application where competitive species are present.
 - Can be done with a hose and hand-gun from a vehicle or with back-pack sprayers.

Combination Programs

- Mowing followed by herbicide application once weeds have regrown to proper stage for effective herbicide control.
- Combinations of herbicide treatments to control a wider range of weed species.

Resistant Vegetation Communities

- Planted species or naturally occurring species beyond ditch line will reduce the invasion of trees
- It is important to observe what local species have the impact of reducing problem weeds and brush and to add them to the list of compatible vegetation.

- Competitive species include bird's-foot trefoil, crown vetch, specific aster and goldenrod species, dense low tree/shrub species and other native competitive species (Appendix A)
- Native herbaceous and short tree and shrub woody communities that provide thick cover and dense shade, shading out wild parsnip seedlings and promote herbivory of woody plants due to dense protective cover for rodents (Niering and Egler 1955, Bramble et al. 1990)
 - Goldenrods and aster species have allelopathic qualities that reduce tree establishment by seeds (due to chemicals left by plant debris) (Brown 1967, Horsley 1977) as well as aggressively competing with and shading out tree seedlings
 - Physically selective control of any invading trees in these native zones will need to be carried out to limit injury to the planted or naturally occurring competitive species
 - Spot applications (foliar, basal bark or cut stem treatments).
 - Foliar treatments can be with back-packs or HTV/truck mounted sprayers with hose and hand-gun

Control of Weeds Affecting Roadside Barriers and Other Structures

Mechanical/Manual Control

- Mechanical and manual mowing
 - Regular cutting or mowing can reduce the height of vegetation around structures. It will not control many biennial and perennial species, but if done regularly, it can maintain a safe height for operations.
- Mechanical removal from ditches
 - Mechanical removal of plants and debris limiting water flow in roadside ditches (ditching) is carried to remove dense or tall plants and other material

Herbicide Control

- Spot applications of foliar post-emergence products with residual control will provide season-long control around structures and in maintenance yards.
 - If products are used with no residual control, repeated applications will be needed during the year.

Control of Wild Parsnip

Mowing/Manual Control

- Does not control wild parsnip seed in soil
- Cleaning of equipment critical between sites to reduce movement of seed
 - Mow from less densely infested to more densely infested areas
 - Need to clean toxic plant residue from equipment to protect workers
- PPE important for worker protection from toxic plant residues

Mowing Wild Parsnip to Prevent Seed Production:

- Wild parsnip plants die after flowering, so mowing flowering plants is not necessary to control the plants
- To prevent seed set, it is necessary to mow after each cluster(umbel) has flowered but before seed set
- Timing one or two mowing operations per season is extremely difficult, especially with contract mowing of many roads
 - Wild parsnip plants have variable flowering times starting June, peaks in July and August in Lanark County area, continuing to late summer
 - Within each plant, flowering of different umbels varies over 10 to 14 days
 - In addition, seeds are shed on primary umbels up to a month before tertiary umbels, so some umbels will have seeds when others are starting to flower
- If mown too early the plant just re-flowers
- If mown too late, the operation ends up spreading seed and spreading the infestation
- Regular weekly or bi-monthly mowing of turf will prevent flowering and seeding
 - Only suitable for turf
 - Mowing is not suitable for sites with established herbaceous and woody short tree/shrub species, since mowing decreases the competitive ability of these companion species or even kills them

Mowing to Control Wild Parsnip (general):

- Low mowing of wild parsnip is only suitable for smooth sites, with turf cover
 - Mowing must be low enough to cut the rosettes
 - Not suitable for sites with established herbaceous and woody short tree/shrub species
- During this period, wild parsnip will be present in the turf, so still presents a safety concern for people in bare feet or sitting on the turf
- Low mowing will starve existing wild parsnip plants over a multiple year period
 - Bi-monthly mowing will allow the wild parsnip to re-grow leaves, using up stored reserves
 - Mowing then removes this new growth before the leaves mature and produce new reserves as well as preventing flowering
 - Forces the plants to re-grow new leaves, eventually starving the plants
- After a period of months or years, the plants will die
- Low mowing has been observed to kill wild parsnip seedlings, thus preventing new infestations
 - Low mowing of new seedlings below the cotyledons will kill the seedlings, but could be as low as 2 cm
- Effective seedling control would require at least 2 years of mowing, since 80% of wild parsnip seed emerges in first year and 20% in second year.
- Higher mowing does not control seedlings, disperses wild parsnip seed and has been reported to increase plant flowering in emerged plants and plant numbers the following year
- Mowing is not suitable for sites with established herbaceous and woody short tree/shrub species, since mowing decreases the competitive ability of these

companion species or even kills them as well as increasing the density of wild parsnip.

- Hand grubbing (using a spade for example) or mechanical cultivation are both very effective in killing established wild parsnip if root cut
- Hand pulling plants is very effective especially in wet or very dry soil conditions which makes the root easier to pull out
 - o Black garbage bag mulching of pulled plants is important especially if seed present

Herbicide Control

- Post-emergence product to control rosettes, preferable before flowering in late spring or fall
- Two consecutive years of herbicide application required to control seed bank and break cycle of re-infestation
 - o The Counties of Stormont, Dundas and Glengarry found a program of two consecutive years of treatment followed by two years of mowing to be effective
- Ideal to combine (tank-mix with) with residual product to control new seedlings

Resistant Vegetation Communities

- Regularly mown, medium to high maintenance turf
 - o Note that low maintenance, thin, un-mown turf is not competitive against wild parsnip
 - o Use mowing, over seeding of thin areas and yearly fertilization to thicken up turf areas
- Crown vetch
- Native herbaceous and short tree and shrub woody communities that provide thick cover and dense shade, shading out wild parsnip seedlings
 - o Goldenrods and aster species have allelopathic qualities that reduce wild parsnip seed establishment (due to chemicals left by plant debris) as well as aggressively competing with and shading out wild parsnip seedlings
- It is important to observe what local species have the impact of reducing problem weeds and brush and to add them to the list of compatible species.

Public Relations

- Signage of problem areas or include on trail information signs
 - o identification characteristics with photos
 - o Steps to prevent movement of seed
- Scrubbing stations for vehicle/bicycle/shoe cleaning

Control of Common Reed Grass (Phragmites)

Mechanical/Manual Control

- Mowing or cutting is effective if done at least 4 to 5 times per year
 - o Clean of equipment critical between sites
- Physical removal of root/rhizome not effective

- Movement of contaminated soil is a serious issue

Herbicide Control

- Foliar herbicide application using effective herbicides to plants that have started to flower is most effective
 - Narrow window from September until frost.
- Cutting before herbicide reduces amount of foliage and thus amount of herbicide taken up
 - If cut, let plants regrow to full height before treating

Replant with Resistant Vegetation Communities

- Using transplants for fast establishment
- Re-vegetation as soon as possible after total control or to sections as controlled
- Plant communities suitable for wet areas
 - Native wet area herbaceous or low height woody communities that provide dense shade and aggressive growth
 - Goal would be competitive wet area species such as joe-pye weed, wet area asters and goldenrods (all suitable for seeding), meadowsweet spirea, steeple bush spirea (Appendix A)
 - Regularly mown, medium to high maintenance turf
 - Solid bird's-foot trefoil, tall fescue along wet areas (both suitable for seeding)

Control of Poison Ivy

Mechanical/Manual Control

- Repeated cultivation provides effective control since poison-ivy does not readily establish from stem fragments

Herbicide Control

- Foliar herbicides at appropriate time of year to fully emerged leaves, preferably before flowering
- Combined with residual product to control new seedlings.

Replant with Resistant Vegetation Communities

- As with wild parsnip, replant with communities that prevent poison ivy from establishment from seed.

Public Relations

- Signage of problem areas or include on trail information signs
 - Identification with photos
 - Steps to prevent movement of seed
- Scrubbing stations for vehicle/ bicycle/shoe cleaning

Control of Dog-Strangling Vine

Mechanical/Manual Control

- Mechanical equipment nor manual control do not control dog-strangling vine seed in soil; follow-up monitoring required
- Cleaning of equipment is critical between sites to reduce movement of seed
 - Mow from less densely infested to more densely infested areas
- Mowing
 - Single mowing will not kill dog-strangling vine plants
 - Mowing at least 2 times per season will keep viney growth down to allow access to areas and control new seedlings.
 - In order to kill plants, mowing would need to be repeated on whole area at least 4 times per year for a number of years
 - Mowing is not suitable for sites with established herbaceous and woody short tree/shrub species, since mowing decreases the competitive ability of these companion species or even kills them
- Hand pulling stems can control small stands with repeated pulling over a number of years
- Clipping to remove seed pods before dispersal eliminates seed production
- Hand digging of crowns is very effective in killing established dog strangling vine if all of each crown is removed
 - Black garbage bag mulching of pulled or cut plants is important especially if seed present

Herbicide Control

- Post-emergence herbicide program is effective to control plants
- Two consecutive years of herbicide application required to control all emerged plants on medium dense and densely covered sites
 - In very heavy stands, a second application in first year will kill plants shaded from spray in first application
 - Application the second year is required to control escapes and new seedlings
- Follow-up monitoring and control necessary to control any new seedlings
- Identifying sources of wind-blown seed and control of these other areas is critical for permanent dog-strangling vine control.

Control of Giant Hogweed

Mechanical/Manual Control

- Mechanical control is not recommended due to the risk of sap on the equipment, risk to workers and movement of seed on equipment
- Hand digging (using a spade for example) is very effective in killing first or second year giant hogweed plants
 - Best to carry out and most effective when done early in spring when foliage is small
 - Critical to remove all the crown and entire tap root or plants will regrow
 - Only effective with young plants since tap root up to 1 m deep in older plants

- PPE important for worker protection from toxic plant juices especially considering plant height

Herbicide Control

- Post-emergence herbicide program to control established plants
 - Foliar application once leaves are full size in late spring/early summer
 - Follow-up application later in season and in subsequent years to control escapes and new seedlings
- Follow-up monitoring and control necessary to control any new seedlings
- PPE important for worker protection from toxic plant juices especially considering plant height.

3.5. Weed Species of Concern

Weed Control Issues

Issues pertaining to weed control include site line (tall) weeds, noxious weeds that affect agriculture, brush, and weeds that affect road structure. Specific weeds of concern in Mississippi Mills include:

- Wild parsnip
- Poison ivy
- Common reed grass (phragmites)
- Dog-strangling vine
- Giant hogweed

Weed Control in Specific Areas

Production agriculture areas within Mississippi Mills

- Identified limits for control activities based on neighbouring land use
- Poisonous weeds - parsnip, poison ivy, giant hogweed
- Noxious weeds in Ontario
 - Include Canada thistles, some biennial thistles, knapweed, dog-strangling vine, European buckthorn, leafy spurge, kochia, sow-thistle
 - In areas affecting agricultural (including horticultural) operations
 - Milkweed species are not noxious weeds
- Site lines (tall) weeds

Rural residential areas and towns

- Poisonous weeds - wild parsnip, poison ivy, giant hogweed
- Site lines (tall) weeds

Recreational trails and maintenance facilities

- Poisonous weeds - wild parsnip, poison ivy, giant hogweed
- Zone width each side of trail or facility
 - 2 m on each side of trail (revise as required or as per location)

Safety barriers

- Common reed grass (phragmites)
- Common safety barrier weeds that hide barriers - sweet clover, ragweed, common reed grass (phragmites), grasses
- Site lines (tall) weeds

Information on Problem Weeds

Wild parsnip

- Biology relating to control and spread
 - o Short-live perennial, dies the year that it flowers (sometimes called a biennial)
 - o Has a crown and a tap-root
 - o Spread by seed only, seed lasts 2 to 3 years
 - o Seed wind dispersed a short distance of about 5 m up to a maximum of 13 m.
 - o Produces a low rosette until the year of flowering, up to 6 years in low light, poor or crowded conditions
 - o Susceptible to disturbance
 - o Foliar herbicides absorbed by green, rosette foliage
- Source of infestations to be aware of as related to control
 - o Local, nearby infestations on neighbouring properties up to 10 m away from fence line
 - o Possibly water dispersal of seed
 - o Soil movement due to ditching, cultivation, and capital projects
 - o Movement of seed by maintenance equipment, vehicles, recreational vehicles, and workers or visitors to site. Especially in wet or dewy conditions

Poison ivy

- Biology relating to control and spread
 - o Perennial woody species with different forms - low or tree climbing
 - o Flowers in late May or early June
 - o Main spread is by birds dispersing seeds
 - Horizontal spread of stems is minor, reportedly less than 10 cm per year (Mulligan and Jenkins 1977)
 - o Movement of seed by maintenance equipment, vehicles, recreational vehicles, and workers or visitors to site
 - Especially in wet or dewy conditions
 - o Forms patches by rhizomes or viney stems that can transfer systemic herbicides
 - o Herbicide uptake is effective at time of full leaf emergence, flowering or later
- Source of infestations to be aware of as related to control
 - o Local, nearby infestations on neighbouring properties as far as local birds fly.
 - o Movement of seed by maintenance equipment, vehicles, recreational vehicles, and workers or visitors to site and along paths.

Staghorn sumac (sumach)

- Benefits of sumac (sumach) on roadsides

- Strong soil and bank stabilizer that out-competes invading weeds and brush due to dense, shading canopy.
- Total control on roadsides is not recommended.
- Zonal plantings along fence line/forest edge are desirable on roadsides for brush control and erosion protection.
- Concerns about animal visibility could require control of as much as 50% of the roadside depth of sumac or in specific areas such as corners with wildlife sightline concerns.
 - Control in these areas will be a regular on-going operation
- Biology relating to control and spread
 - Perennial species with extensive, spreading root system
 - Forms dense thickets due to suckering from roots
 - Red, showy fruits that remain on stems over winter
 - Cut stems break down and seal over within an hour after cutting
 - Herbicide uptake best when flower bud present, also in winter
 - Application timing not as critical, since winter or spring applications can be effective
- Source of infestations as related to control
 - Local, nearby infestations on same or neighbouring properties
Underground roots sending up new shoots from root suckers
 - Capital projects
 - Important to provide input to limit locations of designed plantings of sumac
 - Use of alternative species such as grey dogwood.

Common reed grass (phragmites)

- Biology relating to control and spread
 - Perennial, grass species with aggressive rhizomes/ stolons
 - Flowers late in year from September on
 - Prefers wet sites, but will grow in range of conditions including dry, gravel maintenance yards
 - Almost impossible to physically remove plants and rhizomes
 - Herbicide uptake at time of flowering or later. All foliage required for optimum herbicide uptake
 - Mowing or cutting plants before treatment reduces foliar area and in turn reduces amount of herbicide plant takes up
- Source of infestations to be aware of as related to control
 - Movement of rhizomes/stolons and seed by road maintenance equipment (ditching equipment), road vehicles and recreational vehicles that drive through plants disturb the soil
 - Capital projects
 - Bringing in or movement of contaminated soil

Dog-Strangling Vine

- Biology relating to control and spread
 - Perennial plant propagated only by seed

- One older publication indicates that dog-strangling vine has rhizomes but this is not true
- Only reproduces by seed which is wind dispersed
- Plant has a crown that produces multiple, viney stems each season
- Important to remove isolated plants or groups of plants first which are easiest to control and will limit spread to new areas
- Large infestations difficult to control due to dense growth that limits walking and seed bank; require 2 year program of control treatments with follow-up monitoring
- Source of infestations to be aware of as related to control
 - Local, nearby infestations on neighbouring properties especially on windward side due to wind dispersal of seed
 - Movement of seed by maintenance equipment, vehicles, recreational vehicles, and workers or visitors to site. Especially in wet or dewy conditions

Giant Hogweed

- Biology relating to control and spread
 - Short-live perennial, dies the year that it flowers
 - Has a crown and a deep tap-root
 - Spread by seed only, but 98% of seed germinates in the first year
 - Seed wind or water dispersed a short distance of about 10 m but will float longer distances in water
- Source of infestations to be aware of as related to control
 - Local, nearby infestations on neighbouring properties up to 10 m away from fence line
 - Due to water dispersal of seed, look for locations around water bodies
 - Soil movement due to ditching, cultivation, and capital projects
 - Movement of seed by maintenance equipment, vehicles, recreational vehicles, and workers or visitors to site. Especially in wet or dewy conditions
 - Important to remove isolated plants or groups of plants first which will reduce further spread.
 - Concentrate on high-priority areas such as popular natural areas, area along water ways or areas at sides of trails where people may come into contact with plants

Japanese Knotweed

- Biology relating to control and spread
 - Perennial plant, with a horizontal root system that can spread up to 10 m away from the parent plant.
 - Stems grow up to 2.5 cm in diameter and grows in large bamboo-like clumps reaching heights of 1-3 m. Leaves are oval to triangular with pointed tip and flat base that are 10-17 cm long and alternate along the stem in a distinctive zigzag pattern.
- Source of infestations to be aware of as related to control
 - Due to water dispersal of seed, look for locations around water bodies
 - Soil movement due to ditching, cultivation, and capital projects

- Movement of seed by maintenance equipment, vehicles, recreational vehicles, and workers or visitors to site.

3.6. Herbicide Information

- Publication 75 Guide to Weed Control
- Produced by OMAFRA
- <http://www.omafra.gov.on.ca/english/crops/pub75/pub75ch18.pdf>
 - Registered herbicide and control recommendations for roadside vegetation management
 - Sections on wild parsnip, poison ivy and other poisonous and invasive weeds
 - effectiveness of rating of herbicides of weed species and brush species
 - Updated every two years

3.7. Decision Matrix for Primary Weeds of Concern

Wild Parsnip Decision Tree					
Limits of Location	Infestation	Vegetation Goal	Method	Issues	Effectiveness and Follow-up
Any area or No spray zone due to homeowner or environmental sensitivity	Less than 50 plants	Turf with accessible wild parsnip	Low mowing at least 4 times per year, bi-monthly preferable	Homeowner or contractor – cleaning of equipment for safety and spread	Good to poor* repeat as required at least 1 to 3 years for rosettes and new seedlings
Any area or No spray zone due to homeowner or environmental sensitivity	Less than 50 plants	Herbaceous species or shrubs	Spudding or hand pulling*	PPE and disposal of poisonous plants	Excellent repeat required at least 1 year to pull missed rosettes and new seedlings
Any area that is flat and accessible for mowing equipment, 3:1 slope or flatter	Patches or solid zones of infestation	Turf with accessible wild parsnip	Low mowing at least 4 times per year, bi-monthly preferable	Homeowner or contractor – cleaning of equipment for safety and spread	Good to poor* repeat as required at least 1 to 3 years for rosettes and new seedlings
Any area	Pathces or solid zones of infestation	Turf, tall herbaceous species or shrubs	Targeted herbicide application, product with selectivity if possible.	Re-vegetation of areas where majority of plants injured	Excellent Repeat required at least 1 year to capture missed rosettes and new seedlings.
Area suitable for re-seeding	Any size of infestation	Turf, tall herbaceous species, shrubs	Glyphoate applications for spring/fall and following spring at pre-planting; cultivation	Establishment with plugs/plants established site sooner. Seedlings less expensive	Excellent As indicated, repeat herbicide application at least 1 year to capture missed rosettes and new seedlings

*Field observations have found that mowing sites with established herbaceous and woody shrub species decreases competitive ability of companion species and increases density of flowering wild parsnip stems. Poorly timed mowing can increase the number of wild parsnip the following year.

Poison Ivy Decision Tree					
Limits of Location	Infestation	Vegetation Goal	Method	Issues	Effectiveness and Follow-up
No spray zone due to homeowner or environmental sensitivity	Less than 20 plants	Herbaceous species or shrubs	Hand cutting	PPE, poisonous sap on equipment and disposal of poisonous plant material	Suppression Repeat required yearly until infestation controlled
Any area	Patches or solid zones of infestation	Herbaceous species or shrubs	Targeted herbicide application, product with selectivity if possible.	Pre-emergence control as part of product to prevent seeding-in	Good to excellent Repeat as required yearly to get misses and new seedlings.

Glyphosate is less effect in fall. Truivist provides foliar control as well as pre-emergence control to prevent selective control of new seedlings and is option for fall control in turf areas.

Sumac Decision Tree					
Limits of Location	Infestation	Vegetation Goal	Method	Issues	Effectiveness and Follow-up
Any area or no spray zone due to homeowner or environmental sensitivity	Small patches	Turf with access	Mowing 2-3 times per year		Good suppression Repeat yearly
Any area or no spray zone due to homeowner or environmental sensitivity	Small patches	Herbaceous species or shrubs	Manual cutting 2-3 times per year		Good – suppression Repeat Yearly
Any area	Patches or solid zones of infestation	Turf with access	Low mowing 1 or 2 times per year		Good – suppression Repeat yearly
Any area	Patches or solid zones of infestation	Turf, herbaceous species or shrubs	Targeted herbicide application, product with		Excellent suppression depending on application.

			selectivity if possible.		Repeat every 2 nd to 3 rd year.
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Foliar spray less effective due to hairy foliage. Cut and treat to fresh cut stems most effective.

Common Reed Grass (Phragmites) Decision Tree					
Limits of Location	Infestation	Vegetation Goal	Method	Issues	Effectiveness and Follow-up
Any area or no spray zone due to homeowner or environmental sensitivity	Small patches	Turf with access	Low mowing 4-5 times per year		Good suppression Repeat yearly
Any area or no spray zone due to homeowner or environmental sensitivity	Small patches	Herbaceous species or shrubs	Manual cutting 4-5 times per year		Good – suppression Repeat Yearly
Any area	Patches or solid zones of infestation	Turf with access	Low mowing 4 times per year		Good – suppression Repeat yearly
Any area	Patches or solid zones of infestation	Turf, herbaceous species or shrubs	Targeted herbicide application in fall to un-cut plants	Re-vegetation of areas where majority of plants injured	Excellent suppression depending on application. Repeat every 2 nd to 3 rd year.

Re-vegetation with transplants is possible after total control. Goat to have competitive wet area species.

3.8. Seeding / Re-Vegetation of Disturbed Areas

Both low maintenance turf and legume communities such as crown vetch or birds-foot trefoil can be seeded in. Other seed mixes can be used to establish native herbaceous or low height woody communities.

The type of seed selected for planting will depend on the property use adjacent to the road (farm, residential, rural homes, or forested).

In low maintenance sites such as road sites, unmaintained zones around facilities and along trails, seeding will not replace the natural regenerating vegetation, but will mix in with natural

regeneration to provide desired character. Even when seeding turf or legumes, there will be naturalized species mixed in to the final vegetation.

Seeding With Competitive Species that Reduce Weed and Tree Infestation

- Options for establishment that may be quicker than natural regeneration
 - Seeding/planting with natural regeneration
 - enriching the natural site so that new vegetation will dominate
- Custom seed mixes are available from local or Ontario based seed retailers for this purpose.

Re-Seeding of Road Side Turf Following Construction and Road Maintenance

MTO seeding turf seed mixes and the standard seeding specification (OPSS 804) shall form the basis for contract documents (i.e., tenders) when re-seeding or reestablishing roadside vegetation is required.

- these mixes promote rapid grass establishment using improved turf species
 - these are vigorous species compared to native species and have been improved by breeding and selection for various qualities
- these mixes use fast germinating nurse grasses to provide early competitive advantage and early cover
- the specific mix and application method can be adjusted to best suit the project area to adjust for salt impacted areas, lowlands, and acidic soils.

4.0 Relevant Legislation

4.1. Pesticide and Application Legislation

Federal Pest Control Products Act

- Deals with sale, storage, use, transportation and disposal of pesticides
- registered pesticides have specific weeds listed
- Health Canada/ PMRA as a label search site

Provincial Pesticides Act and Ontario regulation 63/09

- Applicators must have required license
- Roadside herbicide control operations and recommendations required Industrial Exterminators License including Public Works IPM certification
- public trail control operations require a landscape exterminators license including applicable IPM certification
- Also determines posting requirements and worker training requirements
- IPM Reporting
 - copies of the pesticide usage on all properties on file by March 31 each year to meet April deadline

Timing Legislation

- Migratory Birds Convention Act limits herbicide application or maintenance work including cutting or mowing in areas frequented by migratory birds during nesting
 - these areas should be marked as environmentally sensitive areas

Buffer Requirements

- Specific buffers are laid out on each herbicide label
 - Product and site specific
 - relates to specific conditions such as location of water bodies, soil type or sensitive vegetation
- avoid specific designated protected areas and wetlands

Noxious weed legislation

- control of noxious weeds is required in areas affecting agricultural (including horticultural) operations
- there are currently 25 weeds considered noxious in Ontario. These include wild parsnip and Poison Ivy
 - listed on the OMAFRA noxious weed site

5.0 Public Education and Information

5.1. Public and Internal Communications Program

- Internal update regularly on operations with all operations staff
 - mechanical control another staff needed to be part of the program
 - safety concerns
 - value of equipment cleaning
 - methods of equipment cleaning, suggest yearly training by oh IPC group
 - working from least infested to most infested areas
 - making sure these staff and any staff we're dealing with the public are up to date on all aspects of the control project
 - Possible location on website
 - suggestion of weekly or bi monthly reminders of current growth stage of wild parsnip, common Reed grass, Poison Ivy with sample photos
 - during herbicide application regular updates on progress year

Herbicide Posting

- newspaper
- possibility of signs in higher risk locations
 - public use areas
 - areas with heavy concerns near schools
- ensure supporting information is provided on website
- in accordance with legislation

Public Education Programs

- information that would assist land owners in wild parsnip or Poison Ivy control or prevention on their roadside sites and properties
 - currently found on the Mississippi mills website and Lanark county website
- reporting site
 - for people to report locations of wild parsnip
 - possibly use Early Detection and Distribution Mapping System (EDDMapS) which is an Ontario site run by Federation of Anglers and Hunters
- Meetings
 - Have a yearly meeting on the wild parsnip program
 - timing prior to herbicide application program
 - Update on progress of control operations
 - Plans for current season

Web Based Information

- Easily accessible with biological, control and useful health and safety information
- focus on poisonous nature and control methods in public area
- information on preventing weed spread
- promotion of alternative control methods

5.2. Required Reporting to Council

- Initiate pre- and post-season updates to Council on:
 - Previous year program summary
 - Pre-season program plan
 - Post-season program review
 - Budget preparation

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Appendix A – Species List

Suitable shrub and short tree species for clear zones, with mature height <0.6 m	
bearberry	<i>Arctostaphylos uva-ursi</i>
bunchberry	<i>Cornus canadensis</i>
creeping or trailing juniper	<i>Juniperus horizontalis</i>
twinflower	<i>Linnaea borealis</i>
partridgeberry	<i>Mitchella repens</i>
dwarf raspberry	<i>Rubus pubescens</i>
lowbush blueberry	<i>Vaccinium angustifolium</i>
Suitable shrub and short tree species for wild life clear zones, with mature height 0.6 to 1.2 m	
bristly sarsaparilla	<i>Aralia hispida</i>
serviceberry, juneberry	<i>Amelanchier humilis</i>
shadbush, serviceberry	<i>Amelanchier sanguinea</i>
New Jersey tea	<i>Ceanothus americanus</i>
narrow-leaved New Jersey tea	<i>Ceanothus herbaceus</i>
leatherleaf	<i>Chamaedaphne calyculata</i>
sweet-fern	<i>Comptonia peregrina</i>
bush honeysuckle	<i>Diervilla lonicera</i>
black huckleberry	<i>Gaylussacia baccata</i>
ground juniper	<i>Juniperus communis</i>
sheep laurel	<i>Kalmia angustifolia</i>
Virginia creeper	<i>Parthenocissus vitacea</i>
shrubby cinquefoil	<i>Potentilla fruticosa</i>
wild black currant	<i>Ribes americana</i>
prickly currant	<i>Ribes cynosbati</i>
wild currant	<i>Ribes hirtellum</i>
prickly wild rose	<i>Rosa acicularis</i>
northern dewberry	<i>Rubus flagellaris</i>
swamp dewberry	<i>Rubus hispidus</i>
steeplebush	<i>Spirea tomentosa</i>
snowberry	<i>Symphoricarpos alba</i>
cranberry	<i>Vaccinium macrocarpon</i>
deerberry	<i>Vaccinium stamineum</i>
summer grape	<i>Vitis aestivalis</i>
fox grape	<i>Vitis labrusca</i>
frost grape	<i>Vitis riparia</i>
Suitable herbaceous species for clear zones, with mature height <0.6 m	
pearly everlasting	<i>Anaphalis margaritacea</i>
field pussytoes	<i>Antennaria neglecta</i>
wild strawberry	<i>Fragaria virginiana</i>
gray goldenrod	<i>Solidago nemoralis</i>

Suitable competitive herbaceous species for wild life clear zones, with normal height from 0.6 to 1.5 m. (Height range indicated - normal height less than maximum); suitable for seeding

yarrow (naturalized) (0.3-0.7 m)	<i>Achillea millefolium</i>
purple-stemmed aster (0.4-1.7 m)	<i>Aster puniceus</i>
panicked aster (0.3-1.5 m)	<i>Aster lanceolatus</i>
flat-topped aster (0.3-2.0 m)	<i>Aster umbellatus</i>
wild bergamot (0.6 to 1.2 m)	<i>Monarda fistulosa</i>
black-eyed Susan (0.3 to 1.2 m)	<i>Rudbeckia hirta</i>
Canada goldenrod (0.3-1.5 m)	<i>Solidago canadensis</i>
grass-leaved goldenrod (0.6 to 1.2 m)	<i>Solidago graminifolia</i>
rough-stemmed goldenrod (0.3-1.6 m)	<i>Solidago rugosa</i>